STAT

[redacted]

Refer: B1-137

Systems Management & Engineering Dept.
Data Processing Section

STAT To: [redacted]
Marketing Dept.

STAT [redacted]

Subject: High Resolution System for Rectification and Transformation of Tilted Panoramic Photography to Produce Standard Format Chips

From: [redacted] - 8 July 1965 STAT

The following memorandum is in response to your request, S.I. 240, 129, dated 6/10/65, establishing requirements for the development of a design concept for rectifying tilted panoramic photography; the resulting outputs to be on "chip" format at a nominal resolution of 400 + lines per millimeter.

Since you are well aware of our present Electro-Optical Rectifier (EOR), it is unnecessary to review its basic design. It is apparent however, that our design concept, with respect to those requirements referenced above, would be largely an extension of the existing operational EOR's.

It is to be noted that we have performed some extensive analysis of one-step rectification of tilted panoramic photographs, and consequently developed the governing mathematical equations. The physical concept is illustrated in the attached schematic for a tilted-pan-rectifier.

While our previous work generally is relevant, we propose that it be extended in terms of more specific applications and specific tolerances. The additional work would require about four or five weeks time (after vacation), and would result in a Technical Report. In the report we would present the feasible approaches, in detail, with respect to more definitized requirements to be furnished by you.

To assist you in developing these more detailed requirements, we have compiled a list of technical questions. Answers to these questions would define, more clearly, the course of our additional investigation by establishing practical constraints and goals.

The questions follow:

INPUTS (I)

I Q1. What is the range of input photographic format dimensions and the range of roll or cut film dimensions?

I Q2. What is the input resolution and focal length of the individual formats over the range anticipated?

I Q3. Is it mandatory to accomplish the input photo rectification and the scale transformation in a single step?

I Q4. What is the maximum tilt angle of the input photos?

I Q5. What is the maximum panoramic scan angle of the inputs?

I Q6. What image formation specifications are applicable to the inputs, i.e., lens distortion, resolution, photographic contrast, sweep nonlinearities and calibration?

OUTPUTS (O)

O Q1. What output resolution is required on the chips?

O Q2. What is the geometric error tolerance, point to point, on the output chip?
For example: our present EOR's are built to meet a 0.0ϕ0-inch error tolerance, as measured from the photographic Principal Point to any point within the output format.

O Q3. What are the output chip format dimensions and are they variable with respect to input format variables?

O Q4. Are the corrections for "S" curve, earth curvature, and atmospheric refraction desired?

GENERAL (G)

G Q1. What type of environment is planned for the equipment?

G Q2. Are there size, weight or power constraints on the equipment design?

G Q3. What operational rate per photo is desired?

G Q4. What time period is planned for development of a working device?

STAT

RSB:hf

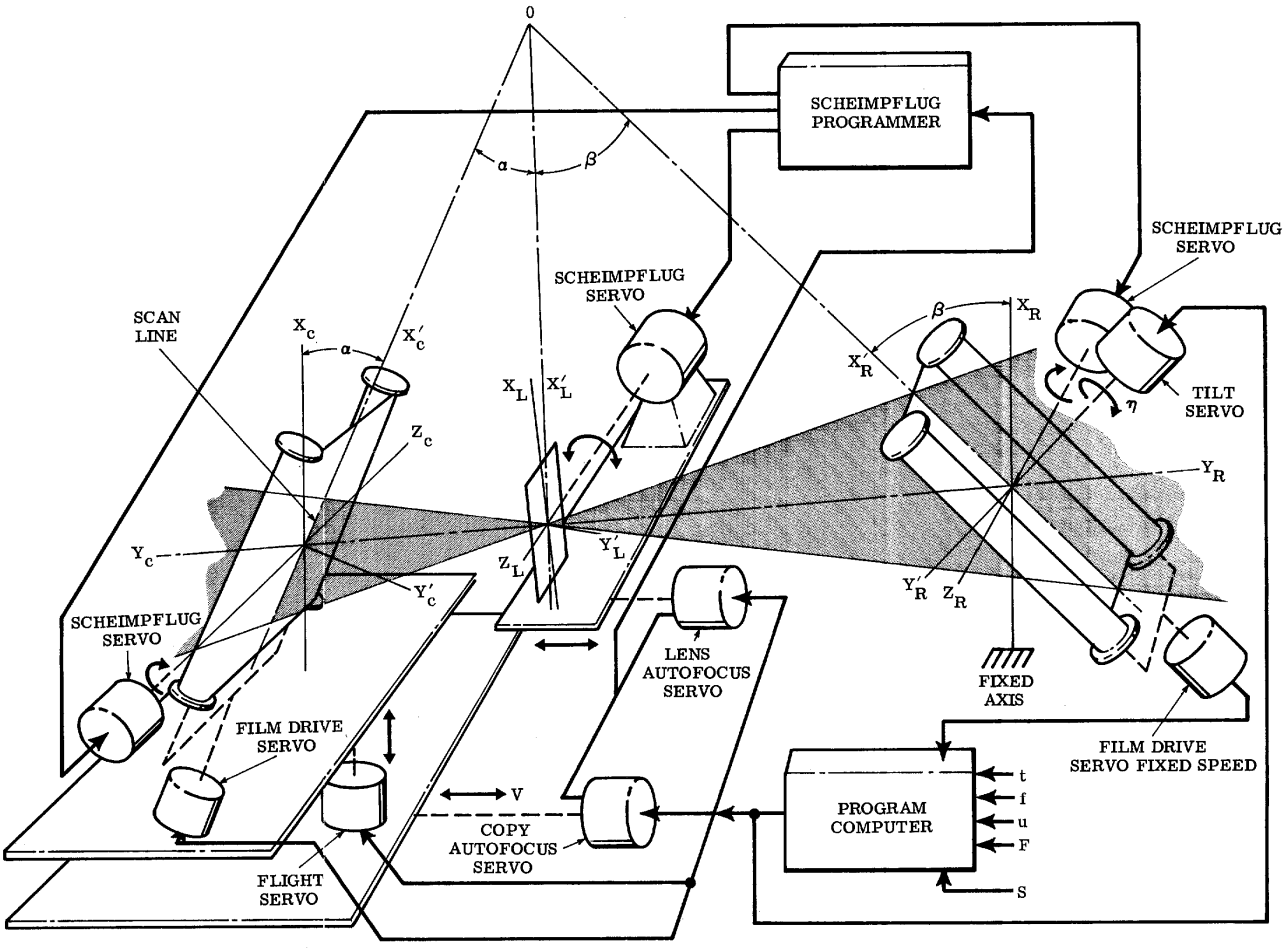
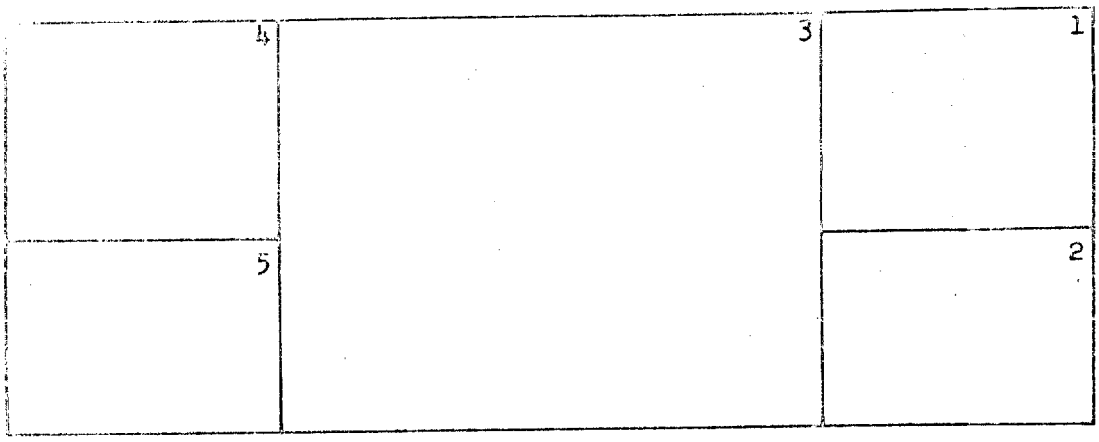


FIGURE 2-1 DESIGN SCHEMATIC

PID TELEPROMPTER PLANNING SHEET

CHANGE NO._____



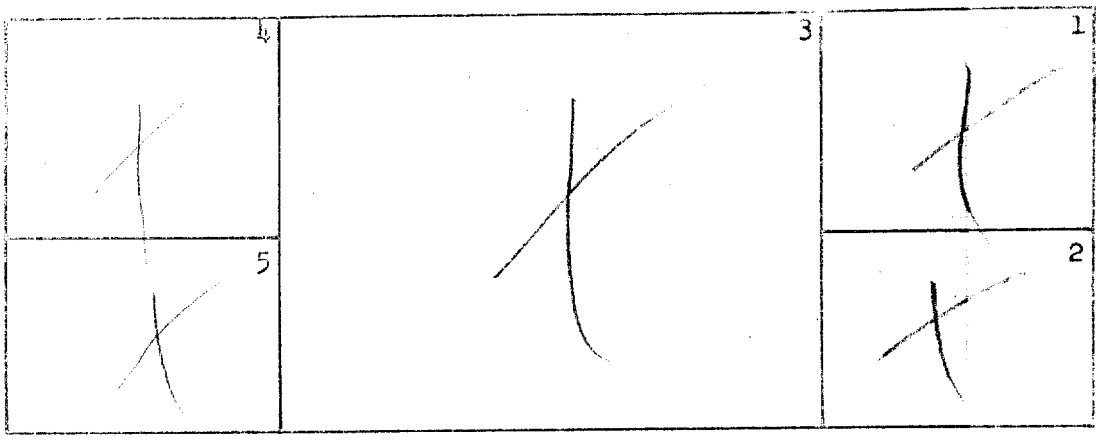
A schematic of the slit scan electro-optical rectifier is shown on the screen. Oblique copy is placed on a flat, glass platen that may be rotated to the correct swing angle. The copy is scanned by a very thin line of light projected from an illuminated slit. A high-pressure mercury vapor tube is used as the light source and an elliptical mirror images the slit in the plane of the copy. Exposure control is obtained by moving a variable density filter between the light source and slit.

The copy is moved passed the projected slit and as this is done, the scanned information is projected to a recording cylinder by a high resolution imaging lense. Rotation of the recording cylinder is preprogramed to correlate with the rate of scan of the copy by the illuminated slit. In this manner the photographic content of the oblique or panoramic copy is transferred to the rectified recording.

NPIC FORM 230

PID TELEPROMPTER PLANNING SHEET

CHANGE NO. 0



The requirement for improvements in equipment for rectifying oblique aerial photography has become of increasing importance in the past few years. This has come about because of the increased use of a variety of types of aerial photography and of the high resolution being obtained. In addition, the requirement for reconnaissance and mapping has increased substantially.

Historically, rectification equipment has been limited to the optical projection type. With a few exceptions only oblique-frame photography can be processed by the optical rectifier. Even with this restriction the optical rectifier is limited in resolution and in range of focal-length and degree of tilt that can be accommodated by a single instrument.

STAT [redacted] has built a universal type electronic rectifier which can rectify all types of photography. Electronic scanning as well as recording is used. Dimensional rectification is accomplished by servo-drives operated from pre-punched tapes. A digital computer prepares the punched tape by solving the transformation equation.

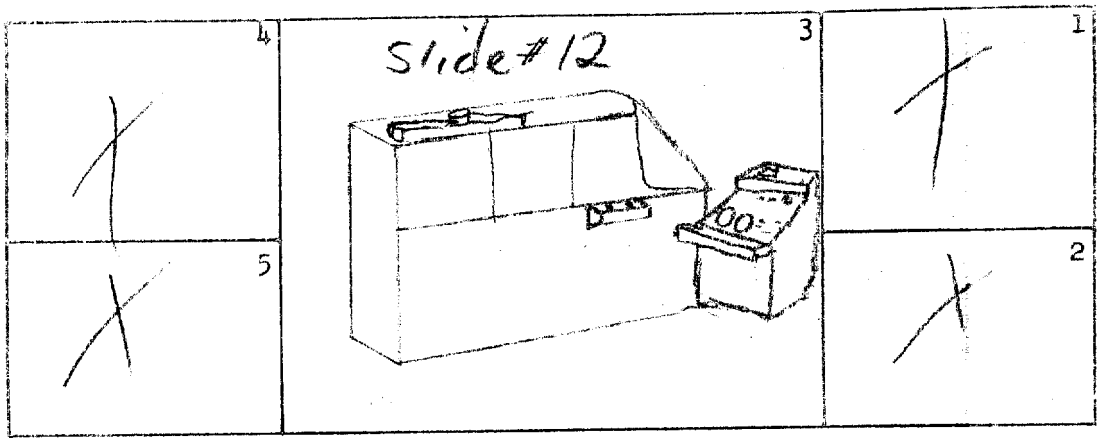
STAT [redacted] has built a spot scanning electro-optical rectifier which accepts oblique frame photography and produces positive prints on paper up to 36 inches by 48 inches in size. A built-in electronic analog computer plus a mechanical computer transforms the dimensions required for rectification.

STAT Both the [redacted] electronic rectifiers have limitations in resolution and speed of operation. These limitations have beem mostly overcome in the design of an Electro-Optical Rectifier more recently built [redacted] for ACIC. STAT

FORM 230

PID TELEPROMPTER PLANNING SHEET

CHANGE NO. _____



In this design photographic information is transposed from oblique copy to rectified print by optical projection. Transformation of both dimensions of the copy is accomplished using servo-drives and punched paper tape derived from a digital computer.

NPIC FORM 230